

























Applications of Area and Volume

Preliminary Course (M2)

PRELIMINARY CAPACITY MATRIX - GENERAL MATHEMATICS

TOPIC: Measurement 2 - Applications of Area and Volume

2 weeks

CONTENT	CAPACITY BREAKDOWN!	DONE IT!!!!	GOT IT!!!!	ON MY WAY!	WORKING ON IT!	HELP!!!!
1. Revision of Area	Formulae sheet Q1-8 LHS, Q9-17					
2. Classification of polyhedra into prisms, pyramids or other	Ex 3C					
3. Sketching 3D shapes using isometric paper	Building from Plans task					
4. Using appropriate formulae in calculating surface area	Ex 3D Q1-4 a, c, e, Q5-19					
5. Using appropriate formulae in calculating volume	Ex 3E Q1-6 a, c, e, Q7-19 Ex 3F Q1-6 a, c, Q8-15, 17-19 Interclass challenge					
6. Application of the relationship between units of capacity and units of volume						

Your say!

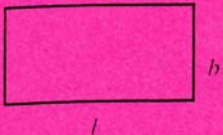
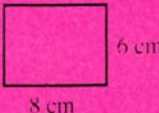
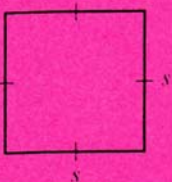
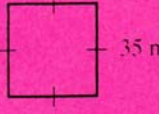
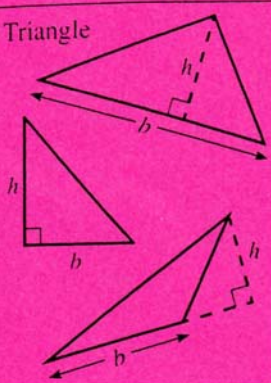

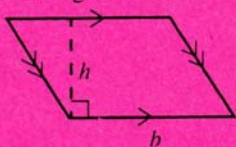
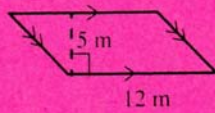
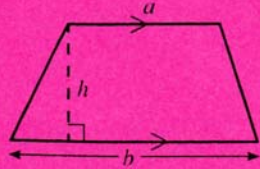
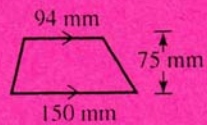
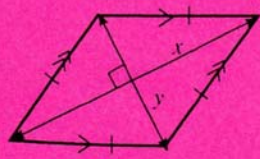

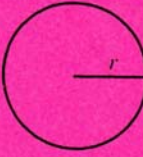

What was the most important thing you learned? _____

What was something new you learnt? _____

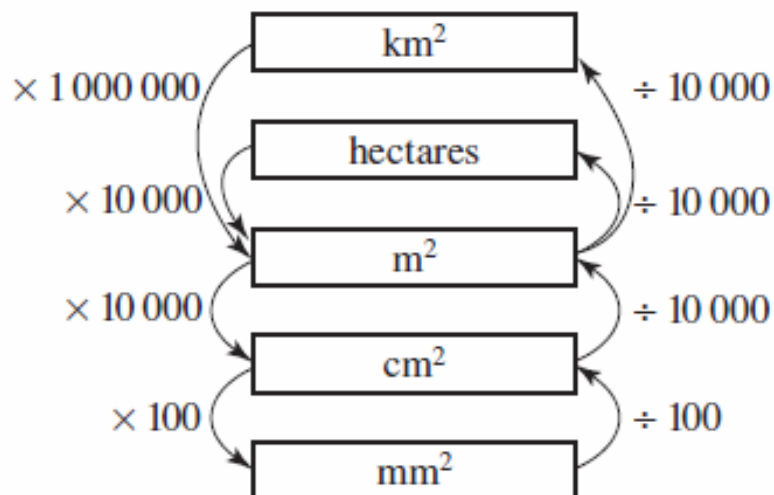
What part(s) of this topic will you need to work on? _____

Area of Plane Figures

REMEMBER TO CHECK YOUR FORMULAE SHEET SO YOU KNOW WHICH TO MEMORISE!!!!

Shape	Area	Formula	Example
Rectangle 	$A = \text{length} \times \text{breadth}$	$A = lb$	 $A = 8 \times 6$ Area is 48 cm^2 .
Square 	$A = \text{side} \times \text{side}$ $= (\text{side})^2$	$A = s^2$	 $A = 35^2$ Area is 1225 mm^2 .
Triangle 	$A = \frac{1}{2} \times \text{base} \times \text{perpendicular height}$	$A = \frac{1}{2} bh$	 $A = \frac{1}{2} \times 28 \times 14$ Area is 196 mm^2 .
Parallelogram 	$A = \text{base} \times \text{perpendicular height}$	$A = bh$	 $A = 12 \times 5$ Area is 60 m^2 .
Trapezium 	$A = \frac{1}{2} \times \text{sum of parallel sides} \times \text{perpendicular distance between sides}$	$A = \frac{1}{2} (a + b)h$	 $A = \frac{1}{2} \times (94 + 150) \times 75$ Area is 9150 mm^2 .
Rhombus 	$A = \frac{1}{2} \times \text{product of diagonals}$	$A = \frac{1}{2} xy$	 $A = \frac{1}{2} \times 20 \times 18$ Area is 180 cm^2 .
Circle 	$A = \pi \times (\text{radius})^2$	$A = \pi r^2$	 $A = \pi \times 8.5^2$ Area is 227 cm^2 .

Converting units of area



CONVERTING LENGTHS

K. H. D. **M.** d. c. m.

(Note: The 'M' is circled in blue, and a green arrow points down to it from the word 'Metre' written above it.)



Move the decimal point according to the direction you take!

King Henry Died a Miserable
Death Called Measles!

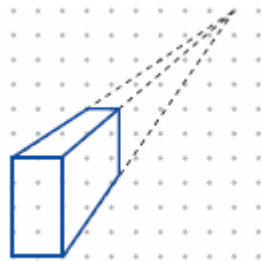
Polyhedra & Prisms & Solids...



1. A prism is a solid shape where any cross-section parallel to the base is a polygon which is identical to that base shape.
2. A pyramid is a solid shape with a base and triangular sides that meet in an apex.
3. The net of a solid is how that shape would look if it were unfolded and flattened.
4. Solid shapes when drawn in perspective converge on a vanishing point. This point is best found by drawing the shape on isometric paper.

PERSPECTIVE DRAWING

When drawing a solid shape, the sides should slightly converge so that if they were extended, they would meet at a similar vanishing point. This can be best done using square grid paper.

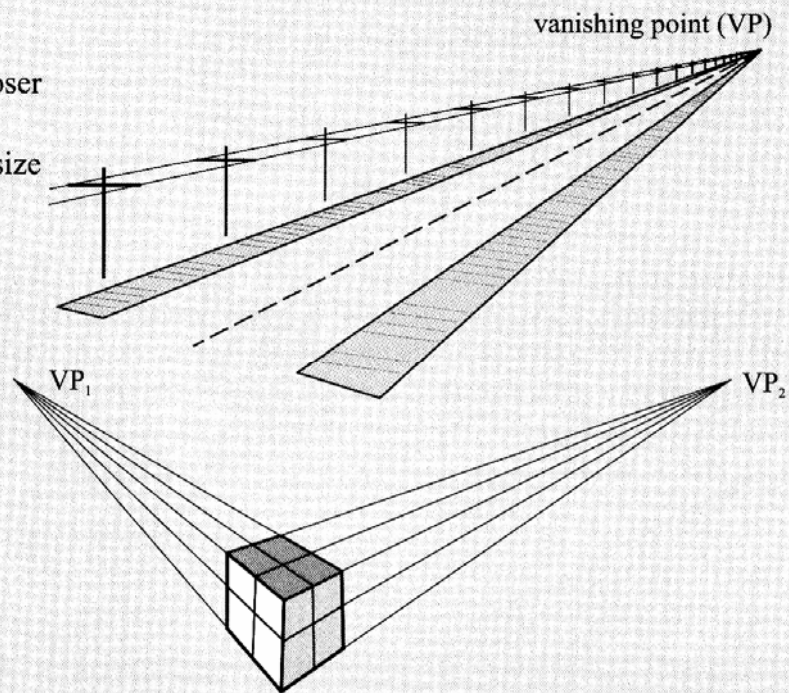


"Sketch" means to use a ruler.
It DOESN'T MEAN to draw to scale.

One-point Perspective

With distance from the spectator

- i the edges of the road get closer together and meet at VP
- ii telegraph poles decrease in size
- iii spaces between poles also get smaller



Two-point Perspective

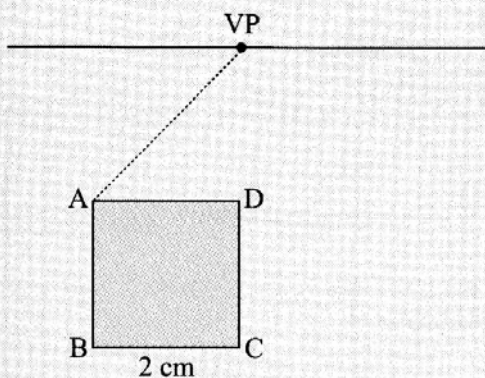
Consider a $2 \times 2 \times 2$ cube:

Notice the use of two vanishing points.

In two-point perspective drawings the only true measurements are those on the common vertical line. All other measurements are affected by the perspective. Technical drawers use measuring lines or grids to draw the correct perspective lengths.

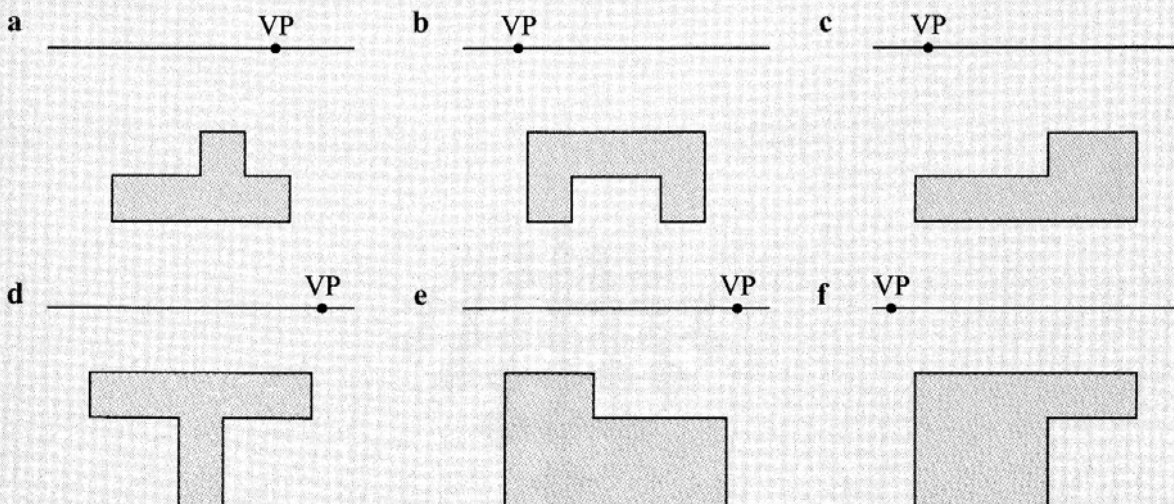
What to do:

- 1 Drawing a cube using one-point perspective.



- a Copy the diagram accurately.
- b Join each point (as shown for point A) to the vanishing point using dotted lines.
- c Draw all the edges along the dotted lines. Make the edges of the cube half the length of each dotted line.
- d Draw the back face of the cube by joining the ends of the edges drawn in c. (These lines must be horizontal or vertical.)

- 2 Draw these solids using the vanishing point given



OBLIQUE PROJECTIONS

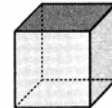
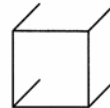
When drawing an object using an **obliques projection**, the lines going back from the front face are inclined at 45° and these lengths are halved.

EXAMPLE

Draw a cube using an oblique projection.

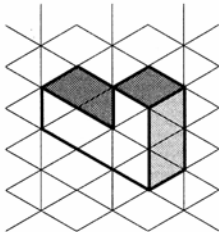
Steps for drawing:

- 1 Draw the front face.
- 2 Draw lines back from the front face at 45° .
- 3 Make these lines half the normal length.
- 4 Complete the cube.
- 5 Draw dotted lines for the hidden edges.

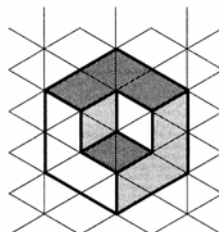


- 5 Redraw these isometric projections as oblique projections.

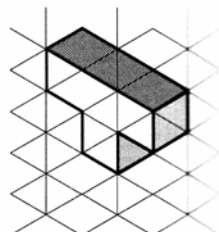
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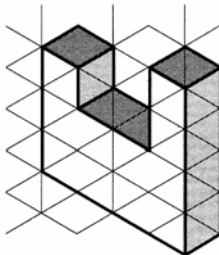
b



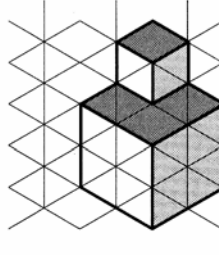
c



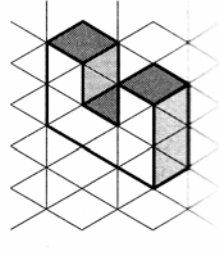
d



e

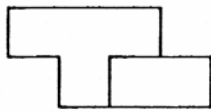


f

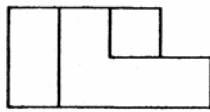


Building from Plans

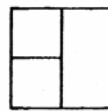
The drawings below show the plans for a 3D object made from 10 **cubes**.



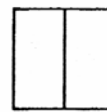
Plan



Front
Elevation



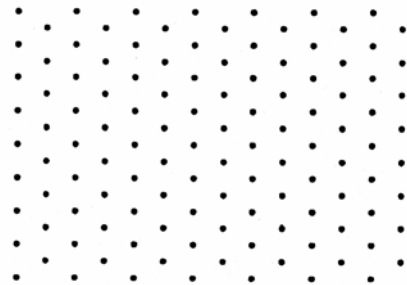
Right
Elevation



Left
Elevation

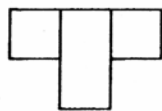
Task 1: Construct this **three dimensional** object from centicubes. How many **cubes** are required? What is its **volume**?

Task 2: Draw an isometric drawing of the object here:

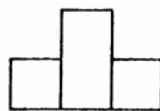


Task 3: Make each object. Draw a diagram of each and write down its **volume**.

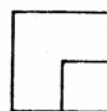
A.



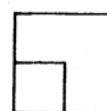
Plan



Front
Elevation

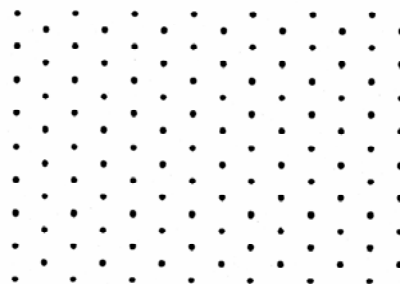


Right
Elevation

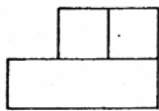


Left
Elevation

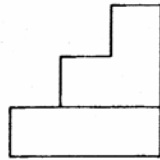
Draw an isometric drawing of the object here:



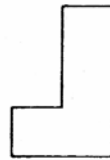
B.



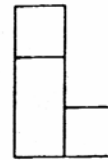
Plan



Front
Elevation

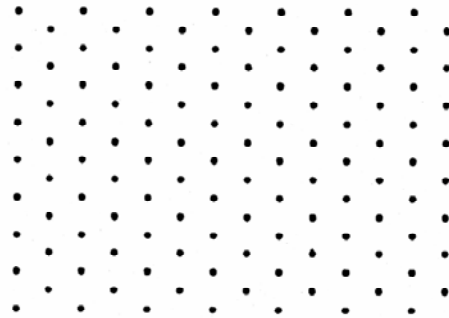


Right
Elevation

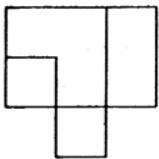


Left
Elevation

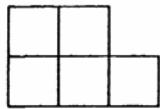
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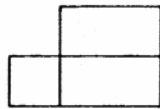
C.



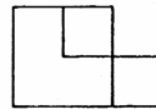
Plan



Front
Elevation

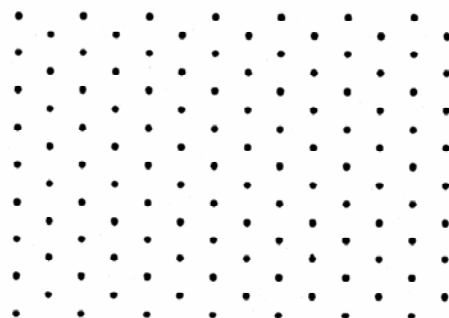


Right
Elevation

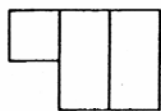


Left
Elevation

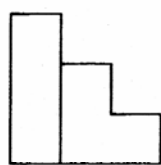
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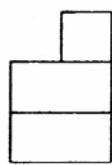
D.



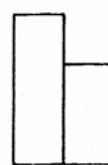
Plan



Front
Elevation

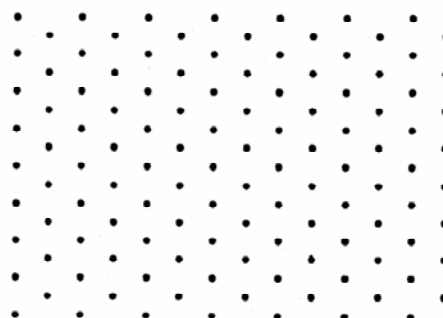


Right
Elevation

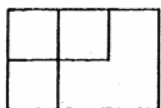


Left
Elevation

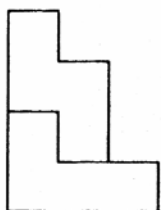
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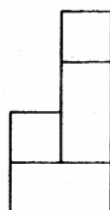
E.



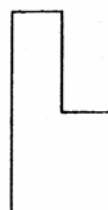
Plan



Front
Elevation

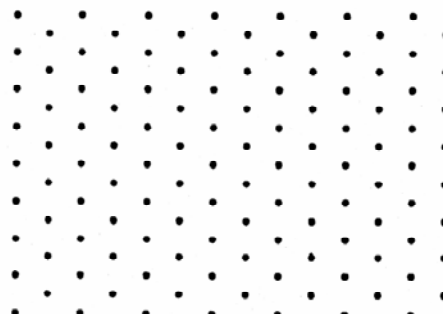


Right
Elevation



Left
Elevation

Draw an isometric drawing of the object here:



Surface Area

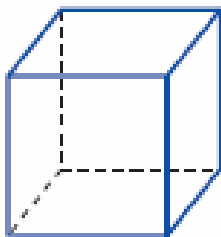


- Surface Area of a solid shape is the total area of each face of the shape.
- The surface area of any shape can be found by adding the area of each face of the shape.
- Remember that careful setting out of your working will alleviate the omission of sides.
- The Cube and Rectangular prism have specific formulae:
Cube: $A = 6s^2$

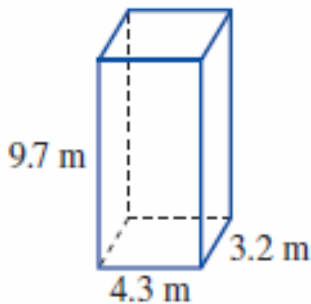
Rectangular prism: $A = 2(LH + LB + BH)$

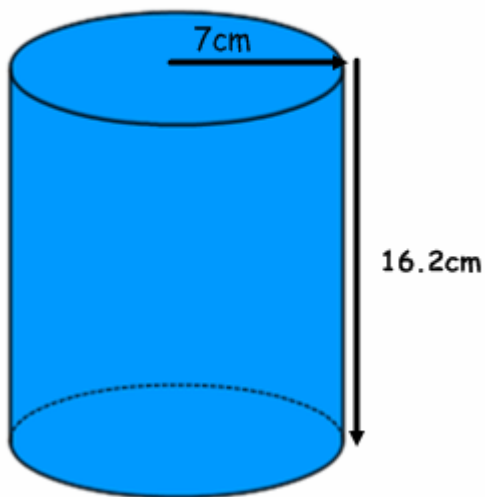
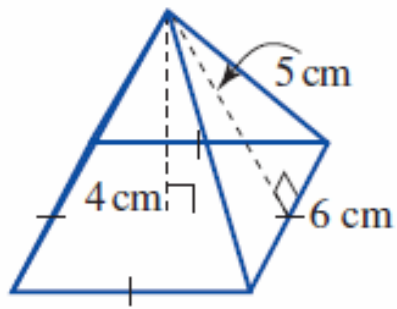
- Pythagoras' Theorem can be very useful in Surface Area, particularly for pyramids.
- Surface Area of a cylinder: $A = \pi r^2 + 2\pi rh$

Calculate the surface area of the following solids:



4.3 cm





Volume

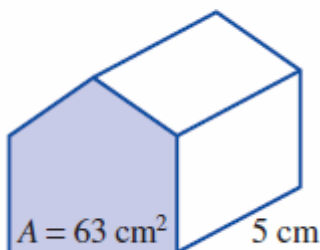
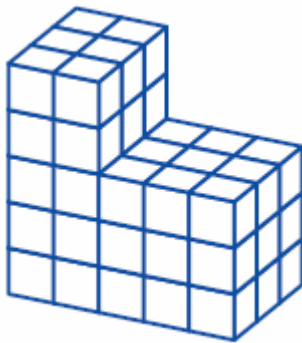


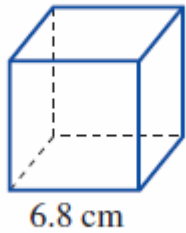
- The Volume of any solid is the amount of space within.
- Volume is calculated by multiplying the area of the cross section (A) with the distance between the two end cross sections (h).

$$V = A \times h$$

- Volumes are often drawn "lying down" so the height is often in a horizontal perspective.

Eg Calculate the volume of the following solids:





eg Calculate the capacity (to the nearest litre) of the cylindrical tank that stands 2.3m high and has a diameter of 3.4m.



Capacity is a fluid measure.

$1\text{cm}^3 = 1\text{ mL}$, so....

$1\text{ L} = \text{-----}\text{cm}^3$

$1\text{m}^3 = \text{-----}\text{L} = \text{-----}\text{KL}$

$1\text{ ML} = \text{-----}\text{KL} = \text{-----}\text{L}$